Tuberculosis in a Developing Country: Experiences of the TB Service at BMH Dharan

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SUMMARY: The notes of 3095 patients who attended the tuberculosis service of BMH Dharan between 1961 and 1982 were examined. Pulmonary tuberculosis accounted for 90% of cases. The overall rates of cure and default were 47% and 32% respectively. The reasons for default which mostly occurred within six months of starting treatment are examined. Changes in the policy of the service are suggested to make its operation more appropriate to its setting in a developing country.

Introduction

Tuberculosis (TB) especially pulmonary tuberculosis (PTB) is one of the greatest medical problems facing Nepal¹. The prevalence of smear positive cases of PTB amounts to 3.5/1000². The small British Military Hospital (BMH) at Dharan in eastern Nepal has operated a TB service since its opening in 1961. The service has steadily expanded to a current level where it consumes a large part of the medical resources.

The aims of this study were to attempt an audit of the service to allow comparison of its effectiveness with the other organisations treating TB in eastern Nepal, to identify problem areas, to suggest avenues for future improvement and to highlight differences in the approach to treatment which are necessary when treating TB in a developing country.

To put the TB service into context it is necessary to review briefly the general situation in Nepal. The country, which lies along the northern edge of India has a population of about 12,570,000 with an annual increase of 2.5%³. It is broadly divided into three zones³. The southernmost is a fertile flat plain (Terai) where 36.5% of the population live and which contains virtually all the motorable roads (3200 km). In the far north is the remote mountainous zone where 6.5% of the people live. Between the two and occupying most of the country is the area of the mid-hills. Here 57% of the population live, many as subsistence farmers. All travel is by foot and during the monsoon travel in many areas is impossible.

The medical services are poorly developed. The doctor/population ratio is 1/42,778 and the hospital bed/population ratio is 1.7/1000³. Several agencies are involved in treating TB in eastern Nepal. The govern-

ment has hospitals in the larger towns. Most have facilities for sputum smears but X-ray facilities are commonly absent. Not all hospitals have permanent medical staff. In the rural areas, health posts staffed by trained health assistants take the place of hospitals. Inadequate and irregular drug supply is the greatest threat to the government TB programme. In practice most patients are required to buy drugs at the bazaar. Private practitioners also treat TB in the towns. Their prescribing is uncontrolled, all drugs being bought privately. The price of drugs currently available in the Dharan bazaar is given in Table I.

Drug price must be related to the local economy. A labourer in Dharan might earn 10-15 NCR daily

Table I
Anti-Tuberculous drugs available in Dharan bazaar

Drug	Cost in Rupees (NCR)
RIFAMPICIN 300	6.15 per capsule
RIFAMPICIN 450	6.75 per capsule
RIFAMPICIN 150	3.00 per capsule
ETHAMBUTOL 400	1.05 per tablet
THIACETAZONE	13.00 per 100 tablets
THIAZINA*	23.00 per 100 tablets
INAH	5.00 per 100 tablets
PASINAH†	36.95 per 100 g
STREPTOMYCIN‡	3.65 per vial
ETHIONAMIDE	Not available
CYCLOSERINE	Not available
PAS	24.95 per 100 g

£1 21.95 NCR

*Combined Thiacetazone/INAH tablet

‡A further 2 NCR is charged per injection

†Combined PAS/INAH preparation

*Now attached to St. Thomas's Hospital, London.

and a porter 20 NCR daily; most farmers have very little available cash, so a frequent cause of default is exhaustion of monies. The two charities, Britain-Nepal Medical Trust (BNMT) and Save The Children Fund (SCF) provide free drug treatment with reliable drug supply. BMH provides free first and second-line drug therapy and also has facilities to deal with the more severe complications of TB. It thus acts informally as a referral centre for BNMT and SCF.

The Nepalese government in conjunction with SCF and BNMT operate an agreed chemotherapy policy of streptomycin and thiazina for 60 days followed by thiazina alone for 10 months³. In the towns however the policy is ignored by private practitioners and it is not strictly adhered to at BMH.

Method

The notes of all patients who attended the TB service at BMH Dharan since its opening in 1961 to December 1982 formed the basis of the study. The separate storage of these notes aided the completeness of the data collection. Details of diagnosis, presentation, places of domicile, outcome and management were extracted from the clinical record. To amplify the radiological data in patients with PTB the presentation chest X-rays of 100 consecutive PTB patients were examined in more detail. The following definitions were used:

A CLINICAL

1. *Cure*. As the study was retrospective cure was defined as that point where the attending physician felt able to discontinue anti-tuberculous therapy.
2. *Default*. Lapse from chemotherapy for a period of 28 days or more.
3. *Poor Compliance*. Lapse from chemotherapy for a period of less than 28 days.
4. *Continuing treatment*. Patients still taking anti-tuberculous drugs.

The attending physician's diagnosis of relapse or primary treatment failure was accepted for the purpose of the study.

B PATIENT CATEGORIES

1. *Serving Soldier* — currently serving British Gurkha soldier.
2. *Family of a serving soldier* — wife and any children under 14 years of a serving British Gurkha soldier.
3. *Ex-soldier* — former British Gurkha soldier.
4. *Family of an ex-soldier* — wife and any children under 14 years of a former British Gurkha soldier.

5. *Nepali Police* — currently serving policeman.
6. *Locally Employed Civilian (LEC)* — a Nepalese civilian employed by MOD or a privately employed Nepalese living or working on the cantonment.
7. *Family of LEC* — wife and any children under 14 years of an LEC.
8. *Villager* — any other patient.

C RADIOLOGICAL PARAMETERS

All chest X-rays were standard PA films. Other projections were not routinely used.

1. *Cavity*. As only a PA film was available a very strict definition was employed: a radiolucent area completely surrounded by a continuous wall or containing a fluid level. This definition undoubtedly underestimated the incidence of cavitation but reduced the chance of counting artefactual cavities produced by coincidental overlap of shadows.
2. *Effusion* was defined as large (filling more than 50% of the hemithorax), moderate (filling 25-50% of the hemithorax) or small (filling less than 25% of the hemithorax).

D PLACE OF DOMICILE

1. *Local* — living in Dharan or its immediate vicinity.
2. *Non-local* — living elsewhere.

E BACTERIOLOGY

1. *Primary sensitivity* — sensitivity of tubercle bacilli from a patient never previously treated for TB.
2. *Secondary sensitivity* — sensitivity of tubercle bacilli from a patient previously treated with anti-tuberculous drugs.

Results

The notes of 3095 patients treated by the TB service between 1961 and December 1982 were examined. There was an overall male preponderance of 2:1. The mean age of all patients was 28.4 years (range of 0.25-86 years) without any sex difference. The distribution of patients according to category was villagers 60%, families of ex-servicemen 16%, ex-servicemen 13% with serving soldiers, Nepali police, LEC and families and soldiers' families together comprising 11%. The numbers of serving soldiers represents an underestimate of the number treated as the clinical records of those treated but not permanently based in Nepal would not be retained at BMH.

New patient attendances have been slowly climbing (see Fig. 1) and in the 24 months between January 1981 to December 1982 a total of 599 new cases were seen.

Fig. 1 New attendances at the TB Service

TB review patients comprise about 50% of all medical review attendances. During the 9 months between September 1982 and May 1983 the numbers attending the weekly TB review clinic varied between 40-70. Most patients have at least one X-ray and many have a sputum smear. Although 69% of patients are managed as out-patients the TB in-patients made very major demands on the in-patient medical resources. Taking first admission alone the cumulative patient weeks of in-patient treatment amounted to 9134 patient-weeks. This figure includes only patients admitted to the acute medical wards or the low dependency wards and excludes those accommodated in the medical hostel which is now supplied totally from BMH.

The diagnostic breakdown of attendances is given in Table II.

A PULMONARY TUBERCULOSIS (PTB)

PTB was the outstanding problem and accounted for 90% of all cases. The sex ratio was in favour of men (2:1) with a mean age of 31 years (range 0.25-86) for males and 26 years (range 0.25-68) for females. 7% of patients were aged less than 5 years at diagnosis. Local patients amounted to 24% while 55% were non-local (some came from as far as Pokhara to the west and as far as Assam to the east). Many of these patients travelled long distances by foot (some up to 10 days) to the hospital. In 21% the place of domicile was not recorded.

Patients, unlike those in UK presented with far advanced disease. The mean duration of symptoms

Table II
Patients by diagnosis

Site of Tuberculosis	Total	% of total	Male	Female
LUNG	2796	90%	1912	884
LYMPH NODES	280	9%	144	136
ABDOMEN	81	2.6%	43	38
MILIARY	69	2%	35	34
SPINE	58	1.8%	41	17
MENINGES	23	0.7%	16	7
KIDNEY	9	0.29%	3	6
SKIN	5	0.16%	1	4
PERICARDIUM	5	0.16%	4	1
EPIDIDYMYIS	4	0.12%	4	0
PERIANAL	3	0.09%	3	0
BONE	2	0.06%	1	1
JOINT	1	0.03%	1	0
BRAIN	1	0.03%	1	0
EYE	1	0.03%	1	0

NB: If TB involved more than one site, each site counted separately.

was surprisingly low at three months and probably represented the time from the appearance of an alarming symptom or more rapid decline in health superimposed upon a longer period of chronic health. Cough was present in 72%, fever in 51%, chest pain in 37%, haemoptysis in 34%, weight loss in 18%, anorexia in 15%, dyspnoea in 14%, and laryngitis in 0.4%. The low perceived prevalence of weight loss is interesting as considerable weight gain occurred during treatment. A minority presented with serious complications such as pneumothorax (1.6%), large pleural effusion (4%), pyothorax (0.7%) or chest wall sinuses (0.5%). Sputum smears were recorded in 62% of which 62% were positive. The overall results of treatment are shown in Table III.

Default from treatment because of its public health importance was examined further — see Table IV.

The chest X-ray appearance in 100 consecutive presentation chest X-rays were examined in detail; 63 were male and 37 female. There were 12 children

Table III
Outcome of patients with PTB

Outcome	% of all PTB Patients
CURED	45%
DEFAULTED	36%
DIED	7%
CONTINUING	14%
RELAPSED	3.4%*

*Of whom 52% were successfully retreated.

Table IV
Default in patients with PTB

	% of all PTB defaulters
LOCAL DEFAULTERS	22%
NON LOCAL DEFAULTERS	58%
DEFAULTERS ADDRESS UNKNOWN	20%
MALE DEFAULTERS	69%
FEMALE DEFAULTERS	31%
MULTIPLE DEFAULTERS	10%
DEFAULT BUT SUCCESSFULLY RETREATED	8%

under the age of 14 years. The children typically had unilateral hilar or paratracheal lymphadenopathy but had in addition evidence of parenchymal involvement in 50%. In adults minimal apical disease was rare, the disease being usually very extensive. In 55% there was involvement of an equivalent of one entire lung field, in 21% marked fibrosis and in 7% major destruction of a lung. Using very strict criteria which almost certainly underestimated the real incidence 29% had cavities. The mean internal cavity diameter was 22 mm with a wall thickness exceeding 3 mm in 13 patients. Pneumothorax was seen in 4% and basal effusions in 10%. Apical pleural thickening or encysted effusion above a tuberculous upper lobe were seen in 24%. Three had miliary TB (all children).

B TUBERCULOUS LYMPHADENOPATHY

This was the commonest minority diagnosis. 280 cases were reported. It was a disease of older children (mean age 15 years) and equally common in males and females. Cervical disease was present in 94%, axillary in 7% and inguinal in 3% (those with disease in more than one site were recorded separately). The disease was often locally advanced (mean duration eight months) with multiple sinuses in 18% yet little in the way of systemic upset. PTB was also present in 31% and 4% had miliary TB. Diagnosis was usually based on a combination of clinical parameters and probability, only 5% being confirmed by excision biopsy. The outcome is shown in Table V.

Table V
Outcome of patients with Tuberculous Lymphadenopathy

Outcome	% of patients
CURED	46%
DEFAULTED	36%
CONTINUING	16%
DIED	2%*

*Death due to PTB or Miliary TB.

C ABDOMINAL TUBERCULOSIS (ATB)

Eighty one cases were recorded. Their mean age was 16.4 years with an equal sex prevalence. Patients presented with advanced disease (mean duration four months). Abdominal pain occurred in 58%, fever in 44%, weight loss in 34%, diarrhoea 31%, anorexia in 22%, ascites in 21% and peritonitis in 3%. Active PTB was found in 22%. The diagnosis was only confirmed by laparotomy in 16%. The outcome is shown in Table VI.

Table VI
Outcome of patients with Abdominal Tuberculosis

Outcome	% of patients
CURED	36%
DEFAULTED	29%
DIED	22%
CONTINUING	13%

D MILIARY TUBERCULOSIS

The diagnosis was based upon typical chest X-ray appearances. 69 cases were recorded. Their mean age was surprisingly high (19 years) with only 24% aged under five years. The sex incidence was equal. Patients presented with a relatively brief illness (mean duration eight weeks) comprising fever 65%, cough 65%, weight loss 32%, anorexia 19%, chest pain 17% and haemoptysis 8%. In 13% the presentation was tuberculous meningitis. Sputum smears were recorded in 30 patients of whom 27% were positive. 70% were managed as outpatients. The outcome is shown in Table VII.

Table VII
Outcome of patients with Miliary Tuberculosis

Outcome	% of patients
CURED	54%
DEFAULTED	19%
DIED	14%
CONTINUING	13%

E SPINAL TUBERCULOSIS

Fifty-eight patients were recorded. Their mean age was 23.8 years (range 1.5-67) with a male preponderance of 2:1. The local disease was usually of long duration (mean 9.6 months) and advanced. They presented with local pain (100%), gibbus (55%), psoas or paraspinal abscess (31%) or some degree of paraplegia (26%). Radiological changes were seen in the dorsal vertebrae (59%), lumbar vertebrae (38%) and cervical vertebrae (8%), (disease in more than one area was counted separately). Active PTB was detected in 33%. The outcome is shown in Table VIII.

Table VIII
Outcome of patients with Spinal Tuberculosis

Outcome	% of patients
CURED	54%
DEFAULTED	24%
DIED	7%*
CONTINUING	14%

*Includes deaths from associated PTB.

F TUBERCULOUS MENINGITIS (TBM)

Only 23 cases confirmed by lumbar puncture were recorded which was surprisingly low. The disease was commonest in children (mean age 9.2 years) and more common in males (2:1). The patients usually presented with far advanced neurological disease (mean duration four weeks) with marked depression of consciousness, established meningism and focal neurological signs. In 43% there was chest X-ray evidence of PTB or miliary TB. On lumbar puncture CSF findings were typical with elevated protein in 95%, lymphocytosis in 91% and reduction in sugar in 86%. Tubercle bacilli were rarely seen on microscopy. Some of the survivors had neurological sequelae. The outcome is shown in Table IX.

Table IX
Outcome of patients with Tuberculous Meningitis

Outcome	% of patients
CURED	30%
DEFAULTED	17%
DIED	43%
CONTINUING	9%

G DEATHS

Two hundred and twelve deaths directly due to TB were recorded of which 87% occurred on the ward. The 13% of home deaths represents an underestimate as the fate of patients not returning for follow-up (recorded as defaulters) was unknown and probably some at least would have died at home. There was an excess of deaths in males (78%) compared with that expected (SE diff. 3.5). In 115 cases death occurred during the initial admission of whom 52% died within seven days. TB accounted for 20% of all hospital deaths.

H DEFAULT

Nine hundred and eight-five patients (32%) defaulted. Their mean age was 29 years and default was proportionally commoner in males (3.4:1). 10% were successfully retreated and 3% are continuing therapy. Of the remaining 87% their fate is unknown. Some probably died from TB and others from other

causes. It was however uncommon for concern to be raised about the patients' general condition at the clinic attendance immediately before default. 9% defaulted before starting treatment and 72% defaulted within six months of starting therapy. Default according to category is shown in Table X.

Table X
Default according to category

Category	% of defaulters	% of all patients in that category
VILLAGER	71%	62%
FAMILY OF EX-SOLDIER	18%	16%
EX-SOLDIER	17%	13%
NEPALI POLICE	3%	3%
FAMILY OF LEC	2%	2%
LEC	3%	3%
FAMILY OF SOLDIER	2%	2%
OUT-PATIENTS	68%	69%
IN-PATIENTS	32%	31%

J BACTERIOLOGY

The results of Ziehl-Neelsen (ZN) smears were always recorded. Only in 10% of cases (mostly PTB) was culture attempted — see Table XI.

Table XI
Results of ZN Smears and TB Culture

ZN/Culture	Total	
ZN+ CULTURE+	174	56%
ZN- CULTURE+	21	7%
ZN+ CULTURE-	76	24%
ZN- CULTURE-	41	13%

+Positive -Negative

Table XII
Sensitivity to Antituberculous drugs

	% Sensitive Primary Cultures	% Sensitive Secondary Cultures
RIFAMPICIN	92%	92%
ISONIAZID	91%	74%
STREPTOMYCIN	80%	78%
PAS	100%	96%
ETHIONAMIDE	95%	92%
ETHAMBUTOL	99%	96%
CYCLOSERINE	99%	100%
THIOSEMI-CARBAZONE	96%	96%
PYRAZINAMIDE	95%	96%
TOTAL	100	27

There was a significant rate (24%) of culture failure in patients with ZN positive specimens before treatment. The results of sensitivity tests carried out since November 1979 when testing against nine anti-tuberculous drugs commenced are shown in Table XII.

K RELAPSE

One hundred and two patients (92 with PTB) were retreated for relapse. The mean time to relapse was 20 months. 50% were cured.

L COMPLIANCE

Evidence of poor compliance was taken from notes of the attending physician supported where possible by objective data such as late clinic attendance or absence of PAS from urine. 237 cases were recorded (7.6%). Age and sex were not predictive. Compliance failure was followed by default in 57% of cases which was significantly more than the expected (SE diff 3.3).

M PROLONGED THERAPY

Some patients with resistant organisms or more often irregular tablet taking were treated for prolonged periods (some for more than 10 years). 273 (9%) were treated continuously for more than 24 months.

N THERAPY

In the early days of the service Streptomycin, PAS and INAH were standard drugs. In the mid seventies the standard drugs were changed to Streptomycin, INAH and Thiacetazone. A variety of other drugs were available and a non-standard regimen was used in 23% of cases. The policy at present is to use Streptomycin and Thiazina (Thiacetazone/INAH combined preparation) for 60 days followed by Thiazina for another 16 months. Mono-therapy was never used except for chemoprophylaxis. A major change in therapy was recorded in 16% of cases which involved the addition of a single drug in 11% of cases. More than five drugs were used during a single course of chemotherapy in 8% of patients. Side-effects severe enough to cause a change of drug occurred in 9%. Age and sex did not seem predictive of side-effects which comprised rash (59%), nausea (26%), dizziness (16%), Stevens-Johnson syndrome (3.6%), impaired hearing (2.4%), goitre (2%), confusion (1.6%), jaundice (0.8%) and exfoliative dermatitis (0.8%). Four died from either exfoliation or Stevens-Johnson syndrome. It was often impossible to implicate a single drug but where the offending

drug was identifiable it was Thiazina 51%, Streptomycin 23%, and PAS 10%. The development of side-effects increased the chance of subsequent default.

Discussion

The TB service consumes a large portion of the available medical and investigative facilities of BMH Dharan. Although TB presents in a wide variety of forms the minor diagnoses will be dealt with briefly allowing a longer discussion of PTB.

Tuberculous lymphadenopathy was usually locally advanced and sometimes atypical with inguinal or generalised lymphadenopathy. Systemic illness was uncommon unless PTB coexisted (31%). Treatment should be commenced on the basis of clinical impression and probability without recourse to biopsy unless there is serious diagnostic doubt. Abdominal TB was difficult to diagnose in the absence of PTB. To avoid unnecessary morbidity and exhaustion of resources, treatment should be started on clinical impression reserving laparotomy for cases of real doubt or complications. In this medical series A TB causing obstruction was under-represented because of patient selection. In those with ascites peritoneal biopsy using an Abrams pleural biopsy punch was useful and safe. Miliary TB and meningeal TB occurred mostly in younger patients and carried significant mortality due to late presentation. Miliary TB was an important cause of undiagnosed fever and hepatosplenomegaly. In seriously ill patients and the absence of adequate supplies of blood for transfusion bone marrow aspiration is a safer investigation than liver biopsy. Patients with meningeal TB usually presented with well marked meningitis and often focal neurological signs. The CSF findings were typical. Although from this study a therapeutic policy can not be defined, good results in later cases were obtained by an induction regimen of streptomycin (IM), isoniazid, rifampicin, pyrazinamide and decrementing prednisolone for eight weeks then rifampicin plus isoniazid for a further seven months. Orthopaedic TB was probably under reported because some of these patients were cared for solely by the surgeons. Spinal TB was usually very advanced locally but responded well to medical therapy without prolonged immobilisation. The milder neurological deficits tended to improve. The more severe forms were probably under represented as such patients were not often admitted.

Pulmonary TB was the outstanding problem. Although the age range was wide (0.25-86 years) most patients came from the economically productive part of society (mean age 29.6 years). Most had advanced cavitating disease, the early apical PTB typical of UK being rare.

The treatment policy employed at BMH evolved over the years to Streptomycin plus Thiazina for 60

days followed by Thiazina for another 16 months. Other anti-tuberculous were available and were used at the discretion of the attending physician.

The agreed national policy for treating TB in Nepal which is used in government hospitals and by BNMT and SCF is Streptomycin plus Thiazina for 60 days followed by Thiazina for another 10 months³. Logistically a shortened programme has many advantages and there seems little doubt that it should be adopted by BMH. Restricting treatment to Streptomycin and Thiazina reduces the development of resistance to second-line drugs and should be continued in accordance with national policy where possible. Second-line drugs however have an important role in treating drug resistant disease, those severely ill especially with tuberculous meningitis and those with serious complications such as pyothorax. The use of prednisolone is controversial but probably has a role in the treatment of meningeal TB, gross pleural effusions and in very ill patients⁴. In UK it is probably not necessary to use pyridoxine routinely to prevent isoniazid related peripheral neuropathy. It has been shown however that in undernourished subjects standard doses of isoniazid cause a high incidence of neuropathy⁵ so in Nepal routine use of pyridoxine would seem sensible.

Standard chemotherapy as used in Nepal can produce cure rates of 90%⁶ so the cure rate achieved by the BMH TB service of less than 50% seems at first disappointing. In the context of the developing world however cure rates of greater than 50% seem elusive and default rates remain high despite the great industry and motivation of TB programme users^{3,6}. The reasons behind default are undoubtedly complex, involving health expectations, standards of general and health education, response to treatment, unpleasant drug side-effects, motivation, distance from the treatment centre, season and domestic or social commitments. Elsewhere in Nepal irregular drug supply and the high cost of drugs are important causes. In this study factors predictive of default were the male sex, villager status (those with lowest educational standards and expectations) and the occurrence of drug side-effects. Age and type of TB seemed less important. Distance travelled from home to BMH surprisingly did not relate to the risk of default. It was not possible from the records to relate default to season especially the monsoon or planting seasons when travel is difficult or economically impossible. As demonstrated by others in east Nepal¹ the bulk of default (72% in this series) occurred within the first six months presumably as symptoms subsided and general well-being returned. Some patients classified as defaulters probably died at home as the fate of those not attending follow-up was rarely established. Against this number being large however was the almost universal absence of serious decline in health as recorded in the notes just prior to default and a

similar default-rate recorded by others¹ in Nepal. Reducing default is difficult. Clearly patient education with reinforcement at each clinic visit particularly during the vulnerable early months is essential. It is interesting to note however that in this series in-patients who were most exposed to health education and used to taking regular medicines defaulted just as often as out-patients. The default rate might have been increased by the national policy of using Streptomycin and Thiazina as standard therapy because of the high incidence of side-effects⁷ but no change in this policy can be envisaged because of its cheapness. Some organisations employ individuals (chasers) to go out into the community to seek out defaulters. This system however could not easily be applied at BMH because only a minority of patients are local and the concept is probably outside the working brief of the hospital. A clear exception to this concerns LECs and patients living on the cantonment because of their interface with the British community. A register of such patients should be kept so defaulters can be rapidly detected and brought back for treatment. The physicians might further reduce default by considerate prescribing particularly avoiding appointments during the monsoon for patients living in the hills and avoiding appointments during the rice planting season for farmers. Poor compliance is a related problem and probably underestimated. Its detection is an important predictor of impending default and much increases the risk of drug resistance. Improving compliance follows the same line as reducing default except that for local patients and probably all LECs and patients living on the camp insurance against poor compliance (but not default) can be achieved by using intermittent fully supervised therapy such as 12 months of Streptomycin (1 g) plus INAH (900 mg) plus pyridoxine (20 mg) twice weekly. This would not be inconsistent with the national policy and produces a good cure rate⁸. For those not supervised combined preparations should be used rather than two single agents to reduce the risk of inducing resistance following irregular drug taking.

In addition to a massive morbidity TB has a significant mortality. TB in all its forms accounted for 20% of all inpatient deaths in BMH. The number of deaths at home was an underestimate due to inadequate recording. Of the inpatient deaths most occurred within the first month of therapy. In some, early death (52% within seven days) was probably inevitable due to the advanced disease but in others the cause was not obvious. Pulmonary embolus, septicæmia secondary to impoverished immunity might be causes but in many the mechanism was unclear⁹.

The demand for treatment of PTB in east Nepal far exceeds the available resources. The selection of patients for treatment and duration of follow-up must be modified from UK standards to meet the local

situation. Smear negative PTB is a smaller public health hazard than smear positive PTB and also carries a significantly better prognosis untreated^{10,11,12}. It might be reasonable to restrict treatment to smear positive cases only, with the exception of soldiers, LECs, cantonment dwellers and probably families of soldiers. The duration of standard therapy should be reduced to 12 months to come into line with national policy³ and extension beyond that limited to those with evidence of therapeutic failure (for whatever reason). Defining cure is difficult. It appears unnecessary to demand universally negative sputum smears in the six months before withdrawing chemotherapy^{13,14,15}. The absence of clinical and X-ray evidence of activity plus a negative sputum at the end of a full course of chemotherapy in the face of good compliance might be considered. To avoid unnecessary retreatment of patients criteria for diagnosing relapse are required. Relapse with fever, cough and haemoptysis can be mimicked by post-tuberculous bronchiectasis. Even the presence of an isolated positive sputum can not be taken as evidence of clinically significant relapse¹⁶. The BTA definition of two positive cultures taken not less than two weeks apart should be applied where possible. In such cases sensitivity testing is indicated as a relapse with organisms sensitive to first-line drugs can be successfully retreated with those drugs¹⁷. In UK some follow-up to PTB patients is usual. In Nepal many patients do not attend follow-up clinics once drugs are stopped and those that do increase the burden on clinic time and on radiological and laboratory resources. Consideration should be given to abandoning routine follow-up of patients who have successfully completed a full course of chemotherapy as the chances of relapse are small¹⁸. Exceptions might be soldiers and Nepalese who come into direct contact with UK personnel e.g. LECs. Currently the TB service puts large demands on the X-ray department and bacteriology service. Chest X-rays are taken at most follow-up clinics and for in-patients chest X-rays are done monthly (more often if indicated). Sputum smears are routinely taken for each clinic visit and weekly for in-patients. It has become apparent however, especially in the context of developing countries that chest radiology has only a limited place in the assessment of therapy¹⁸. It seems of secondary importance to sputum smears. Much time and money could be saved by reducing routine chest X-rays. Although sputum smears give valuable evidence of therapeutic success or failure it has been shown that a smear taken at 5-6 months after starting therapy gives the most useful information¹⁸ and that weekly or even monthly smears are not necessary and can be misleading. Routine sensitivity testing is not required because the prevalence of resistant organisms is still very low.

BMH Dharan has never taken a large role in community preventive medicine. Some BCG immunisations are undertaken and should probably continue for Heaf negative PTB contacts living on the camp and babies born in the hospital but the extension of the service into the community is outside the brief of the hospital. Unlike in UK, contact tracing is not routinely done. In some cases it is geographically impossible and even with local patients it would greatly increase the already large workload without contributing much to general community health as the default rate in PTB patients in Nepal detected by contact tracing is over 70%¹.

In conclusion the following changes in policy at BMH might be considered:

- 1 Reducing the standard duration of treatment to 12 months.
- 2 Greatly reducing the use of chest X-rays and sputum smears used to assess progress while on therapy.
- 3 With the exception of serving soldiers and their families, LECs and patients living on the cantonment treatment of PTB should be restricted to smear positive cases and follow-up of successfully treated patients abandoned.
- 4 Combined preparations especially of second-line drugs should replace single drug preparations.
- 5 Health education regarding the management of TB should be carried out at presentation with enforcement at each visit.

Acknowledgements

I am grateful to the physicians and technical staff who preceded me and whose efforts made this study possible and to Mrs. Smith who typed the manuscript.

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